

SANDIA REPORT

SAND87-2091

Specified External Distribution Only*

Printed February 1988

**Axial Characterization of the
SEPW Penetrator Case**Vesta I. Bateman, John L. Cawfield, Neil T. Davie,
Robert J. Kipp

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
for the United States Department of Energy
under Contract DE-AC04-76DP00789

*Only those recipients external to SNL as listed under "Distribution"
are authorized to receive copies of this report. They are not authorized
to further disseminate the information without permission from
the originator.

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
1 ST REVIEW-DATE: 9/21/05	DETERMINATION (CIRCLE NUMBER(S))
AUTHORITY: <input type="checkbox"/> AOC <input type="checkbox"/> ADC <input checked="" type="checkbox"/> ADD	1. CLASSIFICATION RETAINED 2. CLASSIFICATION CHANGED TO: <input checked="" type="checkbox"/> CONTAINS NO DOE CLASSIFIED INFO 3. COORDINATE WITH: 4. CLASSIFICATION CANCELLED 5. CLASSIFIED INFO BRACKETED 6. OTHER (SPECIFY): <i>Bob buckets (mctrl)</i>
NAME: <i>N. Connally</i>	
2 ND REVIEW-DATE: 7/9/02	
AUTHORITY: ADD	
NAME: <i>Eric Holzer</i>	
<i>per letter add. 10/2/97</i>	

SAND87-2091
Specified External Distribution Only
Printed February 1988

Axial Characterization of the SEPW Penetrator Case

Vesta I. Bateman
Modal and Structural Dynamics Division

With Contributions by

John L. Cawfield
Explosives Testing Division

Neil T. Davie
Shock and Climatic Division

Robert J. Kipp
Applied Mechanics Division II

Sandia National Laboratories
Albuquerque, NM 87185

Abstract

The response of a penetrator structure to a spatially distributed mechanical impulse with a magnitude approaching field test force levels (1 to 2 Mlb) was measured. The frequency response function calculated from the response to this unique forcing function is compared to frequency response functions calculated from response to point forces of $\sim 2,000$ lb and $\sim 100,000$ lb. The results show that the strain gages installed on the penetrator case respond similarly to a point axial force and to a spatially distributed axial force. This result suggests that the distributed axial force generated during a penetration event may be reconstructed as a point axial force when the penetrator behaves in a linear manner.

Acknowledgments

The data presented in this paper were obtained with the assistance of the following people: Anthony J. Gomez and Mark D. Tucker, Modal Analysis; Larry R. Dorrell, Structural Mechanics; Fred A. Brown, Shock Testing; Ben Duggins, Explosives Testing; and William L. Larson, Control and Data Systems.

Contents

Introduction	7
Axial Forcing Function Tests	8
Low-Level Point Force.....	8
High-Level Point Force	9
The Reverse Hopkinson Bar Test Technique, <i>Neil T. Davie</i>	9
Penetrator Structural Response Measurements.....	11
High-Level Distributed Force	13
The Distributed Force Design, <i>John L. Cawfield</i>	13
Penetrator Structural Response Measurements.....	20
Axisymmetric Eigenvalue Analysis, <i>Robert J. Kipp</i>	23
Conclusions.....	27
Future Work.....	27
References.....	28

Figures

1 Penetrator Case Used for Structural Response Measurements for the Three Axial Forcing Functions....	7
2	

3
4
5
6
7
8
9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

Figures (continued)

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

DOD
MCIL
63

Tables

1

2

3

4

5

6

DOD
MCIL
63

Axial Characterization of the SEPW Penetrator Case

Introduction

DOD
MCTL B6

DOD
MTL
13

POD
NOT
B6

DOD
MGT
b(C3)

DOD
MCH
b(3)

DOD
MCT
b6

DAD
MOM
BOB

PCR
MCT L
b(3)

DOD
met
b6g)

DOD
M 3
B 3

DOD
METH
687

DOD
MGT
b(2)

SPECIFIED EXTERNAL DISTRIBUTION ONLY:

Lawrence Livermore National Laboratory (2)
Attn: Jose E. Hernandez, L-339
Henry S. Freynik, L-145
Engineering Measurement Section
PO Box 808
Livermore, CA 94550

1520	C. W. Peterson	7541	N. T. Davie
1522	B. J. Kipp	7542	T. G. Priddy
1522	R. C. Reutor, Jr.	7543	V. I. Bateman (25)
5121	D. F. McVey	7543	D. E. Miller
5144	D. E. Ryerson	7544	D. O. Smallwood
5144	O. M. Solomon, Jr.	7544	T. G. Carne
5165	S. D. Meyer	7544	R. A. May
5165	K. R. Eklund	7544	M. D. Tucker
5165	W. J. Erickson	7551	O. J. Burchett
5165	N. R. Hansen	8152	J. C. Swearengen
5165	W. J. Patterson	8152	N. A. Lapetina
5165	L. B. Traylor	8182	D. B. Nelson
7290	T. S. Church	8241	G. A. Benedetti
7523	P. L. Walter	8316	J. Lipkin
7530	T. L. Workman	8462	R. I. Peterson
7533	F. H. Mathews	8462-1	D. C. Stoner
7533	J. L. Cawlfield (2)	9122	R. H. Braasch
7533	R. A. Benham	9122	B. K. Christensen
7540	T. B. Lane	9122	M. J. Forrestal
7541	R. Rodeman	9122	M. M. Hightower
7541	T. J. Baca	9122	E. G. Kadlec
7541	F. A. Brown	9122	T. M. Leonard
		9122	R. G. Lundgren
		9122	W. K. Tucker
		9122	C. W. Young
		8524	P. W. Dean
		3141	S. A. Landenberger (5)
		3151	W. L. Garner (3)